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Group Polarization, Transition Points and Coherent Market Model

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This article presents an alternative sociodynamic non-linear model of a stock market price changes that describes market phases in a more precise manner than Coherent Market Model. Most importantly it allows, with high accuracy, identification of transition points between phases. The model is based on a theory of social psychology, including in particular the phenomenon of group polarization that provides an explanation of slumps in the stock market. In opposition to the Coherent Market Hypothesis it includes the market phase, which remained unnoticed by T. Vaga. Such periods are characterized by even higher annual expected return rates and better risk-reward ratio.

Journal of Economic Literature classification numbers: G02, G11, G14, G17

1. Introduction

The Coherent Market Hypothesis that introduced sociology into finance opened new doors for research on stock prices. T. Vaga's attempt to create a non-linear statistical model of the market was met with great interest by academics and practitioners. Nonetheless, it was not transformed into a progressive scientific research program, even though the concept seemed to explain the movement of stock prices better. Also, it was not further developed and supplemented and therefore, E. Fama's model still remains the dominating theory. This article presents an alternative sociodynamic non-linear model of market functioning that describes its phases in a more precise manner. Most importantly it allows, with high accuracy, identification of transition points between phases using variables that are possible to estimate with ease. The model is based on a theory of social psychology, including in particular the phenomenon of group polarization that provides an explanation of slumps in the stock market, as well as sudden declines in prices. In opposition to the Coherent Market Hypothesis it includes the market phase, which remained unnoticed by T. Vaga. Such periods are characterized by even higher annual expected return rates and better risk-reward ratio than the coherent market. The ability to identify these opportunities may have an impact on investors' performance.

The new hypothesis describing price dynamics in capital market has proved to be attractive in at least two accounts. Firstly, it broke with the dogma of market participants' rationality, while not excluding that in certain periods of trading, investors behave rationally. Secondly, as the theoretical basis for its model, T. Vaga adopted the theory of social imitation, which was supposed to explain all forms of irrational behavior of investors in the market. The model driven by control parameters was through assumptions used to predict phase transition points, giving investors the opportunity to identify trading periods characterized by

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high expected profit and low risk. On a theoretical basis the coherent market hypothesis definitely better explains changes in prices in the stock markets. It does not also question the random walk in certain periods of trading. Nevertheless, it was not transformed into a scientific research program. The main cause of this fact that should be considered is the too direct implementation of the theory of social imitation. T. Vaga used in his model the probability density function based on the stationary solution of the Fokker-Planck equation. Unfortunately, it is driven by three control parameters that cannot be accurately estimated. Although the author gives instructions how to determine the value of each of them, these methods can still be considered as highly arbitrary. The created model turned out to be vague and in practice made it impossible to identify transition points between market phases. This factor is the reason for the fact that the coherent market hypothesis has not evolved into a scientific research program and is not being actively developed by academics and practitioners.

The contribution of this paper is two-fold. First, the author introduces a new market phase under Coherent Market Model which hasn't been detected by T. Vaga. Using S&P 500 quotes from March 1, 1950 to November 18, 2013 it is shown that during this market phase investment performance measures may reach even higher levels comparing to coherent market phase identified under original model. Second, a new approach is introduced allowing investors to identify transition points between market phases with the use of commonly available market data.

In the next section the author presents brief literature review concerning price and volume dynamics in a market models which extend Vaga's concept or attribute to it. In section 3 the theoretical background of two well-identified and described phenomena of group cohesiveness and group polarization is introduced, which both have a major impact on decisions made by individuals. In section 4 the author provides a remodeled structure of T. Vaga's market model introducing new phases and their characteristics. In section 5 an implementation study is performed and concludes in the last section are presented.

2. Literature Review

E. Callen and D. Shapero were first to propose the model similar to Ising that might be adapted to the theory of organized social behavior and developed a nonlinear statistical model (Callen & Shapero 1974). Their "theory of social imitation states that the polarization of political opinion in social groups undergoes transitions between states of interim disorder and more orderly coherent states. These ideas were then applied by T. Vaga to describe stock market price moves (Vaga 1990). Vaga's model show that markets do not always exhibit random walk properties. Such periods are usually followed by phases of unstable chaotic market and herd behavior which creates trends. Transitions from random–walk markets to periods in which herding dominates are most likely to be of an unstable nature. Crowd behavior can lead to a unstable market or to the most rewarding investment opportunities characterized by long term trending markets that should be of special interest to investors. Herd or crowd behavior is defined in Vaga's model as a state of order in a complex system comprising a large number of independently acting subsystems. Many researchers working on market dynamics and traders decision making process obtained some significant results. Among many worth mentioning are works on dynamics of prices (Kaizoji, Bornholdt & Fujiwara 2002) and herd behavior (Chamley 2004) which give some supportive background in understanding transitions between market phases. Other works show dynamics of price changes during speculative bubbles and market crashes (Kaizoji 2000), (Krawiecki & Holyst 2003). Some

of the results (Challet, Marsili & De Martino 2004) are in the area in econophysics and literature called “minority games” which can be defined as the situations where agents strive to belong to the global minority. The other group of results show solutions made under voter model where agents strive to belong to majority and that result in herding behavior (Granovsky & Madras 1995). Some works show results on models combining minority and majority features (Badshah, Boyer & Theodosopoulos 2004). However, all of the models mentioned above struggle to find an empirical application. The input they require cannot be simply calculated or obtained with the use of commonly available market data. What more, some of them need to be arbitrary chosen from a set of possible values.

3. Theoretical Background

The sociodynamic model of the market described in this article is based on the theory of social psychology. In particular, on two well-identified and described phenomena of group cohesiveness and group polarization, which have a major impact on decisions made by individuals. The starting point is the state of the market that E. Fama defined as informationally efficient. Investors independently analyze information randomly coming to the market, which results in decisions that cause the true random walk of prices. At the moment it is difficult to deny the existence of this type of behavior in the stock markets. More than 40 years of empirical research conducted in light of the efficient market theory has confirmed that at certain periods of trading price changes are undoubtedly random. However, the same group of studies detected phases in which the random walk does not occur. Under E. Fama’s theory such intervals are specific anomalies, while in the concept of T. Vaga they took the name of ordered (coherent) price changes or chaotic fluctuations. Any such deviations from investors’ "independent thinking" are generally explained by "groupthink" or "herd behavior" influence, which according to most recent research significantly impair the rationality of decisions. The theory of social psychology identifies two main situations in which individual opinions are heavily determined by the ones voiced by the group. They are the so-called phenomena of group cohesion and group polarization. As will be shown later in this article, both occur in stock markets and both condition investors’ decisions during certain periods of trading.

It is believed that the group achieves a state of cohesion between its members where there are bonds linking them both to themselves and to the group as a whole (Forsyth 2010) Individuals who identify with opinions displayed by the group mentally classify themselves as members. Such categorization leads to a situation in which stereotypes shared by a group increasingly begin to affect the minds of the individuals, which leads to thinking and behaving in accordance with standards imposed by the group. This process in the theory of social psychology is known as depersonalization of self-perception (Hogg 1993). Most recent findings show, however, that bonds that bind the individual to a group, bringing it into the state of cohesion, are not being made spontaneously. They must therefore be formed. In an open system, such as capital markets, one may identify at least three informal groups created by market participants. One gathers investors who believe that stock prices are currently underestimated, the second considers them to be overestimated and the third is uncertain of the current situation and remains outside the market. However, only the first of these can reach a state of cohesion. It is believed that only positive factors can cause permanent identification of individuals with a group, which at a later stage determines such transition. If, therefore, over a longer period of time essential (key) information is interpreted positively by most of the investors, the group has a chance to reach a state of cohesion. Studies show that the unity of attitudes is one of

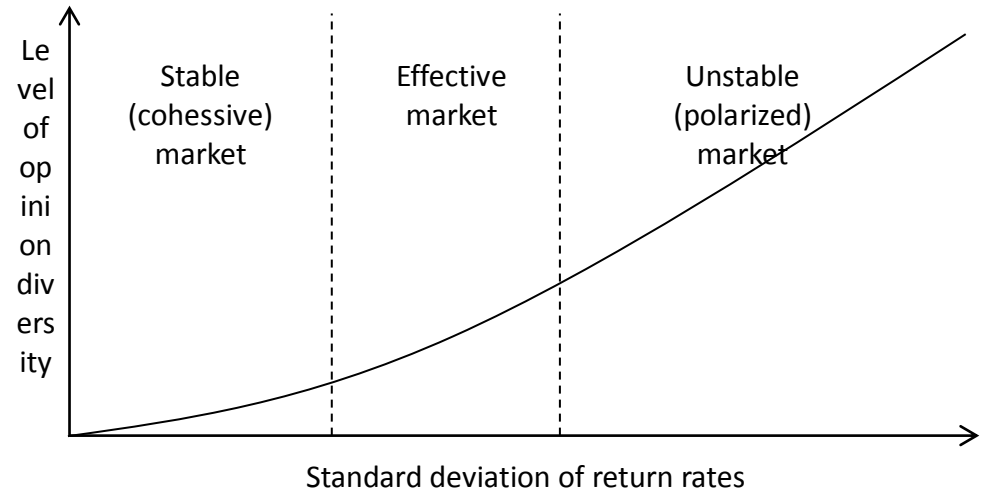
the strongest elements that bind the group (Tajfel 1982). A shaped slowly upward trend reinforces the sense of community and homologous positive assessment of incoming information (Hoyle & Crawford 1994). At this point "group thinking" dominates the market and manifests itself by forming a distinct growth trend. On the one hand it is driven by group members blindly accepting its positive appreciation, on the other hand by new investors who are in fear of losing achievable profits and take long positions in the market. Research shows that the results enhance the unity of the group, and the unity of the group causes an increase in results (Mullen & Copper 1994). This phenomenon can explain the formation of the upward trend in cohesive markets. It continues as long as key information that contributed to the creation of the group and its transition into a state of cohesion remains current.

The second phenomenon that reveals a symptom of "group thinking" is called group polarization, which in some ways is the opposite of cohesion. In theory, this phenomenon is described as the tendency of groups to express more extreme views than the initial views of members forming the group. It has been noted that it manifests regardless of whether the initial attitude is cautious or risky. As a result opinions of such groups, if the phenomenon of polarization appears, are either even more conservative or riskier (Aronson 2010). For its occurrence on the capital market an appearance of two initiating factors is essential. Similar to the case of cohesion, a series of relevant (key) information from investors' points of view must come out. However, this information must also divide market participants in their interpretation of its impact on the valuation of stocks. The weight of these messages must be high enough to trigger discussion among investors, dividing them into two opposing camps. As fairly well known, not all of the information is important enough to concern a significant amount of investors, as not all of the information generates considerable debate. Most has in fact a marginal impact on the valuation of assets listed on the stock exchange. In the theory of social psychology a discussion is considered to be a causative factor triggering the phenomenon of group polarization (Forsyth 2010). Recent studies have also confirmed that it may occur even if the group is not physically together (Yardi & Boyd 2010).

The division of the market into two camps with opposing views results in increasingly larger fluctuations in prices, which are a manifestation of the increasingly radical attitude of both groups of investors. The longer the dispute over its interpretation in relation to current stocks prices the more radical positions are in the two fractions. The phenomenon of group polarization is beginning to be at this point physically visible in current quotations. A natural consequence of investors' actions, which are a derivative of their opinions becoming radical, is the increase in market risk that results in closing of open positions. The larger the scale of price fluctuations, the greater the number of market participants decide not to take part in the "discussion." The effect of group polarization will thus result in increasing market risk and falling turnover. Completion of this process takes place at a time when prices fall to a level in which prior information cease to be valid and do not cause opposing views: a unstructured open system slowly begins to organize. An inverse process that caused the destabilization slowly begins to occur. Underrated stocks no longer cause group polarization but encourage purchasing. Investors are returning to the market, turnover grows and risk gradually decreases. A natural consequence of stabilization will be a strong increase in prices. The process ends when risk drops to a level in which "group thinking" ceases to take place or the "discussion" between investors re-start.

The two phenomena described above affecting decisions taken by investors are located at opposite poles in terms of its determinants. On the one hand we have the state of cohesion and unity of market opinion. On the other hand, the polarization state and opposing opinions, which together with a progressive discussion, become more and more extreme. Visible effects of the first state are decreasing price fluctuations and gradually increasing turnover. The second is characterized by strong price fluctuations resulting in the collapse of the stock market and a significant decline in turnover. Between cohesiveness and polarization, however, the best described and defined state of the market appears: a state in which the group does not influence investors, taking independent decisions based on their own assessment of the information and price changes are purely random. It is an efficient market, an intermediate phase between the two extremes dominated by "group thinking". It can be argued that it is the natural order to which the market returns whenever it undergoes excessive stabilization (cohesion) or destabilization (polarization).

Figure 1: Market states



4. The Model

Over 20 years ago T. Vaga depicted the capital market by the theory of social imitation, thus providing the foundation that explains price behavior that is incompatible with the concept of the efficient market. The four phases described by the author in which the market could be found and the corresponding different shapes of return rates probability density function were a kind of breakthrough. However, the concept of the coherent market had one major drawback. It was the use of the Fokker-Planck equation stationary solution to describe the varying probability density function. The inability to accurately estimate the control parameters precludes the use of the model in empirical research. However, there is a solution to this problem, which T. Vaga did not notice. It is the standard deviation. Through a thorough analysis of stock prices or market indexes an interesting relationship can be observed. The shape of the returns probability distribution curve is modified by the change of the standard deviation. In theory, the difference in its value should only flatten or narrow the distribution curve, but in the case of stock returns this is not so.

Figure 2: Weekly return distribution

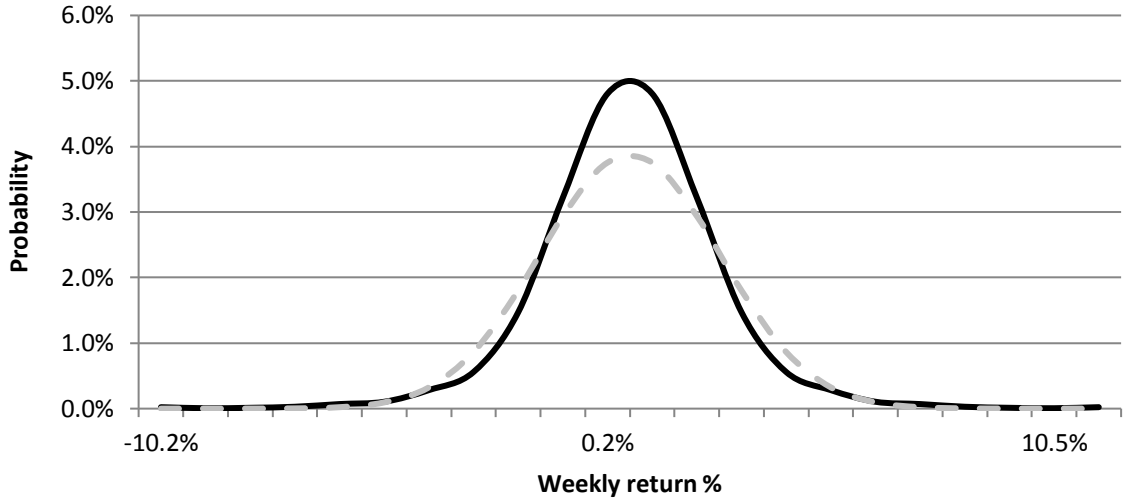


Figure 2 shows the distribution of weekly returns (solid line) against a normal distribution (dashed line). From empirical studies it is known that the probability distribution of the stock market returns is Pareto-stable with an alpha coefficient of less than 2 (Calvet, Fisher, & Mandelbrot 1997). Thus, they are somewhat more concentrated compared to the Gaussian curve, and the average is greater than zero, due to the fact that during the long period of time stock prices increase. Still, regardless of these differences the change in the value of the standard deviation for symmetric distribution should not fundamentally modify the shape of the curve. However, in the case of stock returns this phenomenon occurs. It is therefore possible to replace the three control parameters used in the coherent market model with a variable of standard deviation.

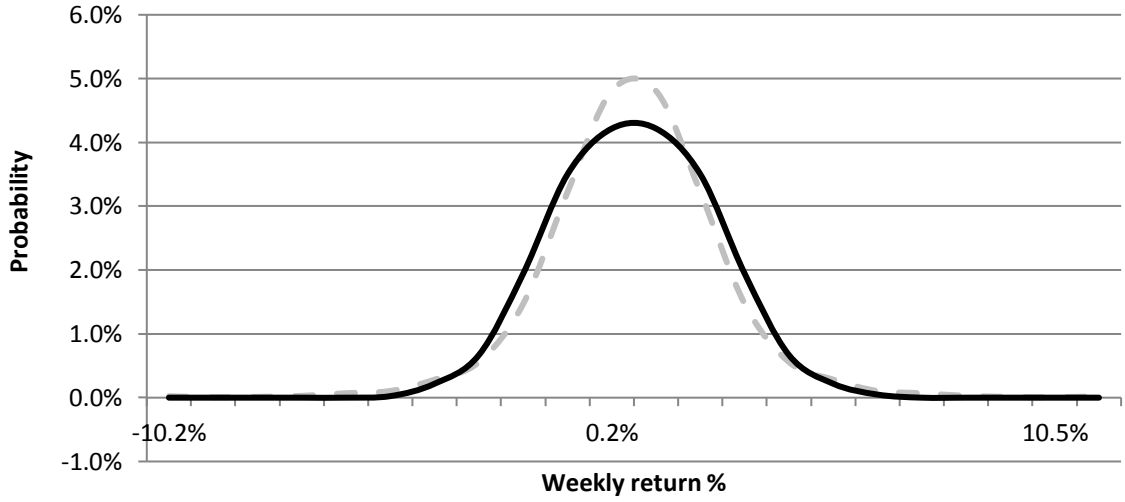
T. Vaga did not notice one more thing, namely that the herding behavior is not homogeneous. As discussed earlier, the theory of social psychology suggests that there are two well-documented and identified phenomena that affect the opinions of individuals. On the one hand, the state of cohesion that bonds the group and opinions it proclaims. On the other hand, group polarization dividing the market into two camps that radicalize their positions over time. The reflection of these two phenomena can be seen in changes in stock prices. If we assume that the efficient market is a natural state for stock markets, in the case of cohesion opinions, convergence will result in abnormally low levels of price fluctuations. For a polarized state they will be abnormally high. Thus, if the shape of the returns probability distribution curve varies with the change in value of the standard deviation than each of the market states shown in Figure 1 must have a different average rate of return. Awareness of this association may have a significant impact on investors' long-term profits. However, this is not a complete picture of the market functioning model. The three market states described above do not necessarily have to define the phase in which it currently is located. It is rational to assume that within a given state there may be two or even more phases with different specificity. Such situation takes place in the case of the polarized market that was characterized earlier. The phase of market destabilization starts when important (key) information comes to the market, which demolishes relatively independent opinions expressed by investors. Their division into two camps and conducted discussion cause significant price fluctuations. Investment risk represented by the standard deviation increases, causing a gradual positions closing by some of the investors. The longer the dispute is conducted the clearer the effect of group polarization is, and the more divergent opinions in the market become. As a result of increasing price

fluctuations more and more investors withdraw from the market, which further accelerates the decline in stock prices and trading volume. The destabilization phase ends when the standard deviation of returns reaches a local maximum. At this point, the price achieve a level where risk has become acceptable to some investors, and the subject of divergent opinions has ceased to be important. A reversed process to the one described above begins. Attractive stock values cause the return of investors. The trading volume and prices gradually rise; the standard deviation of returns decreases and the market enters into a phase of stabilization.

4.1 The Market Phases

Academics generally agree that the natural state of the capital market is a random walk of prices, which is characterized by a time-dependent diffusion of the returns probability distribution. In this phase, investors interpret the information coming to the market as relatively homologous but their opinions are not biased in any way by "group thinking". The actions of individuals are therefore fully independent. It is important that during the random walk phase there is no important (key) information approach that either divides or unites investors. Changes in stock prices are therefore truly random and comprise the resultant of information of unessential or moderate influence on listed assets valuation.

Figure 3: Random walk phase



On efficient market, the stock returns distribution is very close to normal, with a positive average near to zero, which is also characteristic for the whole range of records independent of the phase. A fundamental feature of this period of trading is its unpredictability. Price changes do not admittedly have a large range but are chaotic and usually result in a small and unstable bull or bear market. Similarly, like the directions of volume movement that additionally at this stage are not correlated with changes in prices. It should, however, be remembered that the longer the period of random walk lasts the greater the probability of positive changes in volume due to historical observations of the markets. The phase ends when the standard deviation exceeds one of the critical points shown in Figure 1. If it drops below the lower level, then the market undergoes a stable (cohesive) phase. If, however, it rises above the other two critical points, defining the scope of changes characteristic to the random walk, then the market undergoes a phase of destabilization.

Flowing into the market essential (key) information, which unambiguous positive assessment unites investors causing the market to pass into a stable phase. Price volatility is below the critical level, and the average change of returns begins to recede from zero in the positive direction. Investors make decisions biased by opinions of the group, ignoring unfavorable information and at the same time over-interpreting the importance of neutral and positive ones. The longer this phase of cohesion lasts, the greater the number of investors who take long positions in fear of losing potential profits at abnormally low market risk (standard deviation).

Figure 4: Stable (cohesive) phase

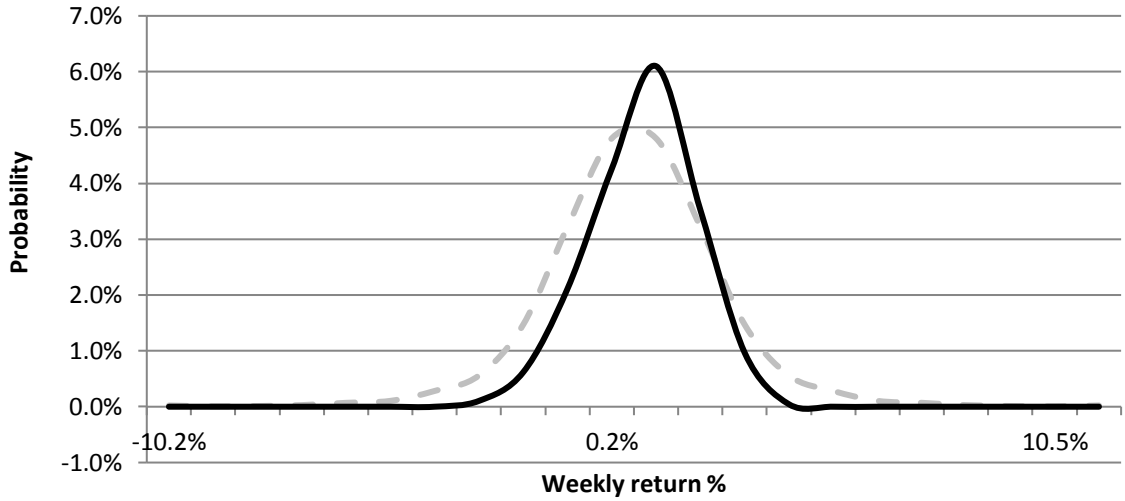
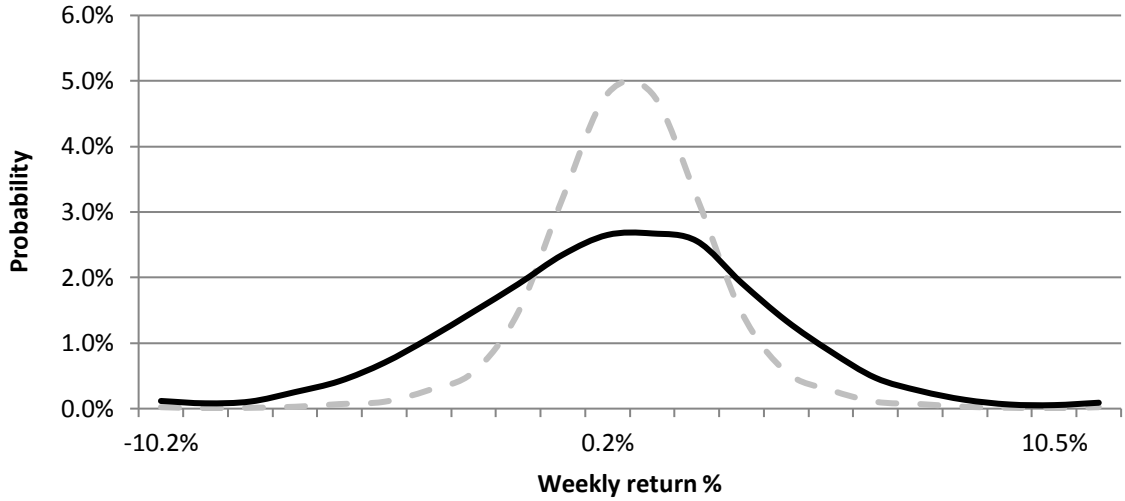


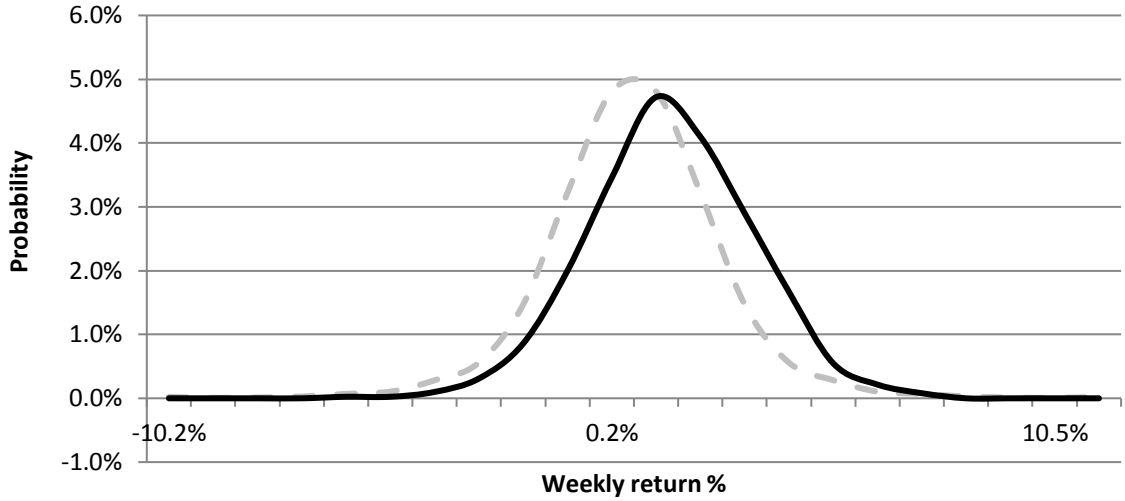
Figure 4 shows the distribution of weekly returns, which at this stage are much more concentrated, and their average is more positive than usually for the market. For these reasons, such periods of trading should be of particular interest to investors. An above-average rate of return at little price fluctuations creates a stable trend in the market that is constantly fed by investors who feared the loss of expected benefits. Although the stable phase bears some resemblance to the coherent market phase defined by T. Vaga, at least two significant differences between them can be indicated. Firstly, the negative side of return rates distribution does not have a long tail, as was the case in the coherent model. Secondly, the state of cohesion results in the presence of only upward trends. The phenomenon of transitioning the group into the state of cohesion is not observed if its members do not perceive positive identification with the group, and as such it is difficult to regard losses caused by keeping long positions with falling stock prices. The stable phase ends when values reach the level in which relevant information causing market transition to the state of cohesion cease to be relevant. The influence of group thinking on decisions made by investors disappears, which makes the standard deviation of returns grow, exceeding the bottom critical point (shown in Figure 1). The market becomes efficient and price movements follow the random walk again. The destabilization phase begins when relevant (key) market information divides investors into two groups with opposing opinions. Discussion on their impact on the value of the traded stocks leads to group polarization. The standard deviation exceeds the upper critical point and the market moves from the random walk phase to the destabilization phase.

Figure 5: Destabilization phase



The growing opinion polarization of both groups of investors is reflected in price changes, which fluctuations gradually increase in intensity. In the initial stage of the destabilization phase the market is marked by chaotic changes of stock prices direction movements and perhaps even for a certain period of time can strongly run high. As time goes on the dispute grows stronger and results in a rising range of price movements (risk) that can be observed in increasing standard deviation. The distribution of return rates gradually flattens out, and some investors who do not accept this level of variability start to sell the stocks. At this point, the market destabilization phase enters the second stage: closed positions pushing prices even lower increasing the scope of their negative fluctuations. Market risk is increased and becomes unacceptable for subsequent investors. In a fairly obvious way it results in successive position closures and even more dynamic price drops. It should be emphasized that the final stage of the process described above bears the hallmarks of panic selling. It lasts until prices reach a level in which very high risk becomes acceptable for some investors. At this point the destabilization phase ends, and the standard deviation value reaches a local maximum. Change in the volume of trading is highly negative in such periods, which is related to the process of closing positions. Although, in the first stage of the destabilization phase violent and chaotic changes in prices may occasionally result in very high short-term profits; however, investors should avoid such a market. The rapid reversal of the price movements direction can quickly offset the unrealized gains and further holding opened positions can cause the completion of substantial losses. Achieving a local maximum by the standard deviation signals the completion of destabilization and transition into the market-stabilization phase, that is the opposite process described above. The fall in prices to a level low enough that abnormally high risk becomes acceptable to some investors stops the downward movement and gradually reverses the trend.

Figure 6: Stabilization phase



Long positions that are opened incrementally stabilize the market. The standard deviation (risk) decreases with the increase in prices, which further drives the demand for stocks. This is the exact opposite of a self-driving cycle observed in the market destabilization phase. It is worth noting that the stabilizing market should be under special consideration by investors. Both prices and volume grow in this phase much faster than during the cohesive market. Figure 6 shows the returns distribution characteristic for this phase. Its concentration around the mean is not as noticeable as in the cohesive phase and the entire distribution is more firmly moved to the right. The market at this stage is strongly upward, and the appreciation of the prices progresses more rapidly. However, market risk measured by the standard deviation is obviously higher than in the cohesive phase, but still lower than the average level for the entire range of quotations. Including such periods in investment strategies can be critical to achieving superior returns in the long term. Comparing the profit to risk ratio, the market stabilization phase is definitely more favorable than the cohesive market.

Its completion can be done in two ways, which makes it different from the other three phases of the market. If the standard deviation (risk) drops enough to go below the critical point separating the unstable state from the efficient market, the trading passes to prices random walk. It is the most rational end if market stabilization is to be the inverse process of the destabilization phase. However, it may happen that at some stage of the market stabilization new relevant (key) information will again divide investors into two camps. The initial process of group polarization will be visible in the increasing standard deviation, and the market returns to the destabilization phase. Nevertheless, the identification of this transition is quite awkward. The decrease in the standard deviation is rarely smooth and often characterized by many fluctuations. It is therefore difficult to clearly identify whether the increase in the value of risk is only temporary or whether it begins the re-transition to the destabilization phase. The direction of change in volume should be conclusive in this regard. If it grows the market continues to stabilize and the increase in standard deviation is only a fluctuation. In the case where the volume stops growing, or even begins to decrease, it means that the market has made the transition to re-destabilization.

Figure 7: Transitions between market phases

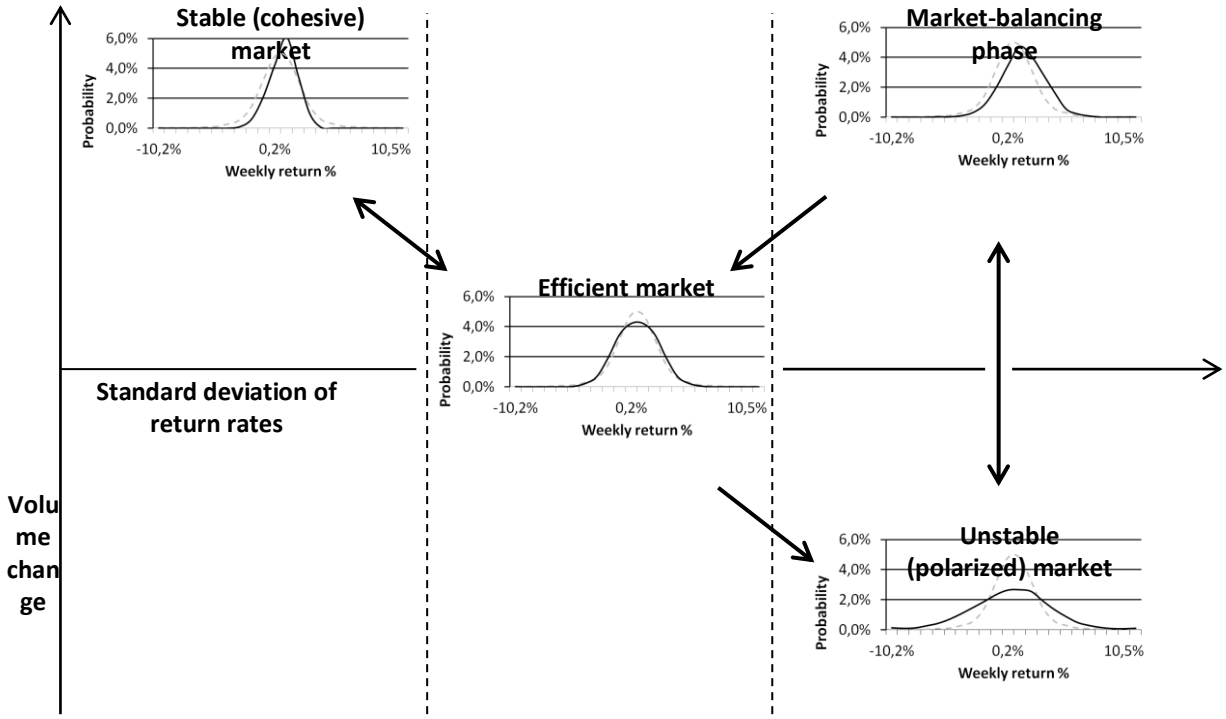


Figure 7 illustrates the possible transitions between different phases of the market. Two critical values of the standard deviation mark the range of price fluctuations characteristic for a random walk. The only exception is the unstable state of the market in which two phases are identified. Both depend on the direction of the standard deviation and volume change as characterized earlier.

Figure 8: Expected return and risk

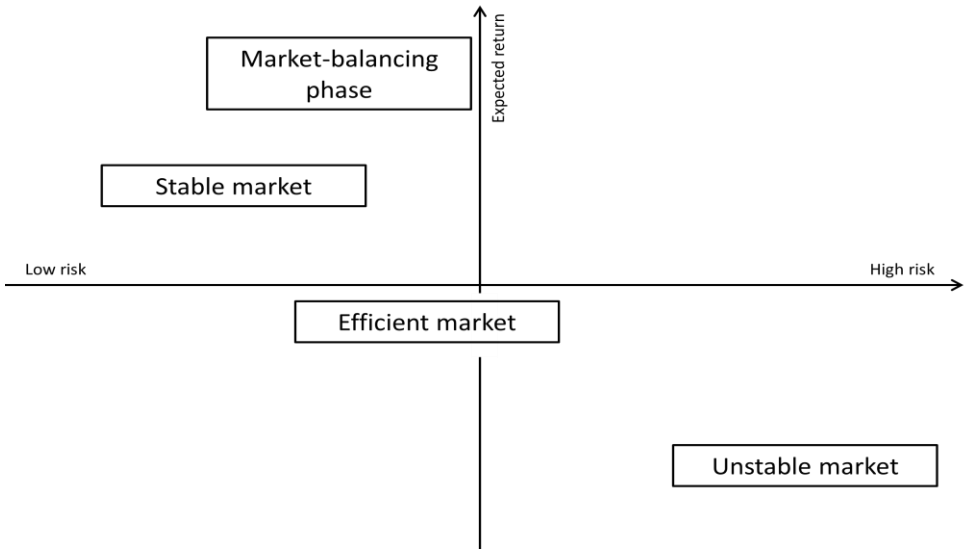


Figure 8 shows the different phases of the market presented in the context of expected returns and risk on the background of the average market value of these two variables

represented by the axes. As mentioned earlier investors should pay special attention to the stable market and market-balancing phase. Both have lower risk than the average. Both can be expected to produce over the average returns from stocks. Missing these low risk and high profit opportunities can lead to underperformance in the long term.

4.2 Test of the Model

The subject of the study was S&P 500 quotes from the period of March 1, 1950 to November 18, 2013. The test of the model was performed on weekly returns that are considerably less variable than daily ones. The standard deviation was always calculated for all the data from the last 13 weeks (quarter), so its value changed with each successive week of trading. It allowed determining moments of phase transitions with only a slight delay. A too short period taken into account when determining the standard deviation could cause major fluctuations. Too long would give a result of much delayed signals of phase transitions. The accepted one was therefore a compromise between the two extremes.

A very detailed analysis of the 13-week moving standard deviation revealed that except for periods with abnormally low and high indications of this variable, fluctuations were contained mainly in a very narrow range, oscillating near the average, which for the test series was around 1.8%. The standard deviation in these periods does not exceed the value of usually 2.0% and it was not in most cases less than 1.5%. These two quantities were therefore assumed to test as critical values separating the efficient market from a stable and unstable state.

Each market phase was isolated as follows. The cohesive market classified periods lasting five weeks or longer if during those periods standard deviation values calculated according to the methodology given above were always lower than 1.5%. If the period is shorter, it was assigned to the phase of prices random walk, which always precedes the state of cohesion. The unstable (polarized) market phase qualified periods of quotations lasting five weeks or longer in which the standard deviation was greater than the accepted critical value of 2.0% and was increasing to a local maximum. It was assumed that it is achieved at the time when the current value of the standard deviation was less than five weeks earlier. In this way not every negative fluctuation was interpreted as a sign of local maximum occurrence. For the efficient market phase quotations for which the standard deviation was in the range of 1.5%–2.0% was included, and those that have not been considered in the phase of cohesion and market polarization due to the short duration time. The periods of trading that have not been assigned to any of the three groups described above were classified as the market-balancing phase. They are ones in which the standard deviation of weekly returns is always greater than 2.0% and is decreasing through the whole period. The phase ends when the variable reaches a local minimum, so the current value of the standard deviation is higher than it was five weeks before (the transition to polarized) or when its value falls below 2.0% (transition to random walk).

4.3 Results

In Table 1 the summary of results obtained for the entire analyzed period of S&P 500 quotes are presented. Differences in the values of the variables set for each of the defined market phases can be quite clearly seen.

Table 1: Basic market characteristics

Market phase	Average annual return %	Average standard deviation %	Average annual volume change %	Risk / reward ratio
Stable (cohesive) market	13.6%	9.3%	28.42%	0.68
Efficient market	5.5%	13.4%	26.75%	2.45
Unstable (polarized) market	-16.4%	25.3%	-35.93%	-1.54
Market-balancing phase	28.3%	13.8%	40.79%	0.49

The results show that both the cohesive phase and market-balancing phase, for companies covered by the S&P 500, should be placed under the special attention of investors. In both cases, the annual rate of return exceeds the risk measured by the value of the standard deviation. It should be noted, however, that the market balancing phase produced twice the annual profit than the cohesive market and at a lower risk / reward ratio. The results also show that investors purchasing stocks contained in the S&P 500 should definitely avoid the market polarization phase, which in addition to abnormally high fluctuations (risk) brings also high losses. It seems to be quite important as well that for the investigated index the efficient market phase was not particularly favorable for investors. The obtained annual rate of return at this stage was trading below the market average, and the risk-reward ratio shows a strongly unfavorable value.

Table 2: Market structure characteristics

Market phase	Market structure %	Number of occurrences	Average duration of the phase (weeks)	Shortest duration of the phase (weeks)	Longest duration of the phase (weeks)
Stable (cohesive) market	40.4%	52	25.9	5*	159
Efficient market	29.3%	79	12.3	1	62
Unstable (polarized) market	17.0%	44	12.9	5*	34
Market-balancing phase	13.3%	42	10.6	4*	31

* Have been established as the minimum by the author of the study.

The data presented in Table 2 indicate that for the analyzed index the dominant phase was not an efficient market but a stable market, which is surprising in the context of E. Fama's theory. Moreover, the random walk was identified only for less than 30% of the surveyed quotations, which means that the remaining 70% is characterized by a form of order, in any case, a lack of complete randomness. However, the random walk phase was reported most frequently in the studied range of data. As expected, the most stable phase turned out to be the cohesive market with an average duration of almost half a year; although, based on adopted criteria, a period lasting for over three years was also identified (from 9/24/1951 to 10/11/1954). The unstable state of the market, represented by two phases turned out, according to the model, to be the most dynamic.

Table 3: Profit/loss characteristics

Market phase	Number and % of occurrences with profit	Number and % of occurrences with loss	Average profit %	Average loss %
Stable (cohesive) market	44 (84.6%)	8 (15.4%)	8.5%	-1.9%
Efficient market	42 (53.2%)	37 (46.8%)	5.3%	-3.0%
Unstable (polarized) market	17 (38.6%)	27 (61.4%)	3.8%	-8.7%
Market-balancing phase	34 (81.0%)	8 (19.0%)	7.0%	-1.5%

The obtained data show once again that the phase of cohesion and market balancing phase should be under special attention of investors not only because of the high expected rate of return at relatively low risk but also because of the high probability of profit, which for the investigated data series was more than 80%. What's more, not only are chances of the decline in prices during these phases insignificant, but also their range is relatively small. Moreover, it is worthwhile noting that for the researched index in the destabilization phase the probability of a drop in prices is not that much, but its average size mainly affected the high negative expected rate of return. If we further consider that this is a very dynamic period of trading, lasting an average of a quarter (13 weeks) then it is another reason why investors should avoid this phase. The above-described observations of probability of increase or decrease in stock prices are consistent with the proposed model. Nevertheless, the characteristics of each phase should be even more featured as their duration increases.

Table 4: Probability of price appreciation vs. duration of the phase

	Duration equal or longer than "n" (weeks)						
Market phase	**6**	**8**	**10**	**12**	**14**	**16**	**18**
Stable (cohesive) market	83.0%	80.5%	84.8%	86.7%	85.2%	95.8%	100.0%
Efficient market	54.2%	57.9%	55.9%	55.2%	50.0%	55.6%	56.3%
Unstable (polarized) market	35.7%	31.4%	27.6%	25.0%	20.0%	12.5%	12.5%
Market-balancing phase	79.4%	80.0%	78.9%	81.3%	90.0%	83.3%	66.7%

If we look at the data presented in Table 4 it is easy to see that, in fact, the effects described in the model for the tested quotes become even more apparent for longer lasting phases. For a stable market persisting 18 weeks or more the probability of price appreciation for the tested data was 100% and only 12.5% for an unstable one. The market-balancing phase for the researched index showed a 90% probability of price appreciation, if its duration was equal to or longer than 14 weeks. An interesting fact is that for the tested range of S&P 500 quotes the efficient market phase was characterized by a relatively symmetrical probability of appreciation and depreciation of prices regardless of its duration.

Table 5: Volume change characteristics

Market phase	Number and % of occurrences with a positive change in volume	Number and % of occurrences with a negative change in volume	Average positive change in volume %	Average negative change in volume %
Stable (cohesive) market	35 (67.3%)	17 (32.7%)	30.1%	-11.3%
Efficient market	46 (58.2%)	33 (41.8%)	27.1%	-16.3%
Unstable (polarized) market	13 (29.5%)	31 (70.5%)	21.4%	-19.7%
Market-balancing phase	26 (61.9%)	16 (38.1%)	25.3%	-12.6%

The direction of the trading volume change in the given market phase is the next relevant aspect of the model. Studies conducted on S&P 500 quotes confirm that main assumptions in this regard were correct. Phases of price increases, that is stable and market balancing, are characterized by a predominance of positive changes in volume. It is not as high as in the case of prices; however, it is still significant. As expected, the polarization phase of the market was dominated by a strong negative change in volume.

Table 6: Probability of volume appreciation vs. duration of the phase

	Duration equal or longer than "n" (weeks)						
Market phase	**6**	**8**	**10**	**12**	**14**	**16**	**18**
Stable (cohesive) market	70.2%	68.3%	81.8%	83.3%	85.2%	83.3%	81.0%
Efficient market	60.4%	60.5%	61.8%	65.5%	75.0%	72.2%	75.0%
Unstable (polarized) market	31.0%	37.1%	34.5%	33.3%	40.0%	50.0%	50.0%
Market-balancing phase	79.4%	80.0%	63.2%	62.5%	60.0%	66.7%	66.7%

Similar to the case of returns, characteristics of volume changes should also consolidate along with increasing length of the market phases' duration. However, this happens only for a cohesive state. In the case of two phases of an unstable market, a gradual disappearance of the volume change probability described in the model is recognized. It is thus the opposite situation than that observed for returns, where duration of the phase highlighted changes in prices assumed by the model.

5. Conclusions

The sociodynamic model of the market presented in this article describes market as not as homogeneous in terms of the returns probability distribution and risk measured by standard deviation as if it resulted from the concept of E. Fama. What's more, within the analyzed data most of the time price changes do not follow random walk.

The results obtained for analyzed data show that the application of the sociodynamic model of the market can effectively identify transition points between phases. What's more, it requires variables, which can be easily calculated on the basis of historical records. The ability to identify a stable phase and stabilizing-market phase, characterized by a low value of risk/reward ratio, can lead to gaining much higher returns in the long term. Similarly as the ability to identify inception of the market polarization phase can reduce losses in a stock portfolio. A simple calculation made on the basis of the data presented in the previous paragraphs shows that holding long positions during a cohesive

market and market-stabilization phase, while being out of the market for the rest of the phases, gave an average annual return of 16.3%. The same rate for a buy and hold strategy stood at 13.8% with significantly higher risk. As can be seen gaining above average returns does not necessarily mean the need to beat the market. Also interesting is the fact that only for less than 30% of the time changes of S&P 500 quotes took the form of a true random walk. It is difficult to argue that for the remaining 70% of the time the market was characterized by some kind of order, but certainly price changes were not completely random. This means that in these market phases an application of investment strategies based on a technical or fundamental analysis may lead to generating above-average returns. Certainly, however, the ability to identify market phases protects investors against the pointless use of these strategies in the context of an efficient market.

The study of the S&P 500 index based on the sociodynamic model of the market also showed that crowds, not individuals, largely determine price changes. Rational and independent thinking leading to truly random price changes were only revealed within narrow range localized between two extremes. On the one hand beliefs consistency and on the other hand polarization, leading to destabilization of the market: the two states in which the behavior characteristic for the crowd take precedence over an individual assessment of the situation. States in which the investors' behavior, just as the crowd, may be predictable to a certain extent, as demonstrated by the findings presented earlier. It cannot be assumed that the results obtained for the S&P 500 quotes from 1950 to 2013 confirm the existence of a stable market and market-balancing phase in similar proportions and with identical characteristics in the future. Similarly, it does not mean that they are applicable to other markets. They do mean, however, that the sociodynamic model of the market can lead to better understanding of market functioning and provides investors with an effective tool that may help to achieve higher performance in the future.

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